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## SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....\$3.50 a year.  
Great Britain and Europe..... 4.50 a year.

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OUR PRESENT KNOWLEDGE OF THE HIMALAYAS.<sup>1</sup>

THIS was the subject of an able paper read at Monday's meeting of the Royal Geographical Society, by Col. H. C. B. Tanner (Indian Staff Corps), who for many years has been one of the officers of the Indian Survey, most of his time having been spent in various parts of the Himalayas from north-west to south-east. The paper was illustrated by a large number of admirable drawings by the author, which afforded an excellent idea of the physical and picturesque aspects of this great mountain system.

With regard to avalanches, Col. Tanner stated that they play a great part in the conformation of the topography, — a greater part, indeed, than is generally supposed, — and this factor has not received the attention it deserves at the hands of geologists.

"I became acquainted," he said, "with four distinct kinds of avalanche, which, perhaps, are called by distinctive names by mountaineers, though I have been unable to ascertain them. The first, and the most common, is the precipitation of a mass of new snow from slopes which, from their steepness, are unable to retain more than a limited quantity of snow on them. They occur generally in winter and in early spring, and are the cause of the results just described. The second kind of avalanche is a descent of old snow, which is loosened by the heat of the sun. They may be heard throughout the summer and autumn, and are dangerous from the unexpected and irregular manner in which they slide off. The sportsman and traveller should guard against them by intelligently placing his camp in some sheltered spot out of their reach. This class is not usually of any great extent or weight, but such avalanches are of constant occurrence. The third kind can only be seen when the mountains are of peculiar formation or structure, and are really ice and not snow avalanches. They are of very constant occurrence in some localities, more particularly where small glaciers are situated high up on the crest of mountains, and are gradually pushed over the edge. In Lahaul, in the company of a friend, we watched the face of the well-known Gondla cliffs from the right bank of the Chandra River, and saw a number of these ice-falls, which came down every few minutes, filling the air with the noise of the loosened rocks and ice-blocks. The fourth kind of avalanche is one that I have only once seen, and have never known described. It is very curious, being the movements of billions of snowballs, which, in a stream a mile or half a mile long, I saw slowly wind down the upper part of an elevated valley in the Gilgit-Dareyl Mountains. I was after *Ibex* at the time of the occurrence, and was watching a herd of these animals, when I became aware of a low but distinct and unusual sound,

produced by a great snake-like mass of snow winding down one of the valleys in my front. It occasionally stopped for a moment, and then proceeded again, and finally came to a rest below me. I found this curious movement of snow was produced by countless numbers of snowballs, about the size of one's head, rolling over and over each other. The torrent-bed was full of them, — an accumulation formed by numerous similar freaks of nature. I am quite unable to account for such an avalanche as the one now described. How does it originate, or by what process is the snow rolled up into these innumerable balls?"

Col. Tanner made some interesting remarks on the subject of the line of perpetual snow. "Various authorities," he stated, "lay down such a line with great assurance; but for myself, I find that circumstances of position, of climate, and of latitude, play so great a part in the position of this line that I am unable to define it even approximately. No sooner in one locality, or during one particular season, have I settled, to my own satisfaction, the line of perpetual snow, than I presently have been obliged completely to modify my views on the subject. On p. 124 of the 'English Cyclopædia,' vol. v., I read that snow lies 4,000 feet higher on the northern than on the southern side of the Himalayas. On p. 281, vol. x., of the same work, it is stated that the snow-line on the northern slope is at 19,000 feet, which I should have been inclined to say is 1,500 or 2,000 feet too high. In Gilgit, during the end of summer, I found masses and fields of snow at 17,200 feet; and they extended down the northern slope certainly 2,000 feet, or even more, below that altitude. In Kulu, which has many degrees of latitude less than that of Gilgit, avalanche snow lies in valleys above 8,000 feet throughout the year after a good winter snowfall; but during the past spring, following a very mild winter, I found no snow at all at 8,000 feet. There had been no avalanches, and even in June, at 14,000 feet, snow lay only in patches. I think, that, in determining the snow-line with greater precision than has been done hitherto, scientific men should ascertain those altitudes on which perpetual snow lies on flat places in the position where it first falls, and should neglect the occurrence of a snow-field where it may have been protected from the sun's rays by its occurrence on the north face of a mountain. From memory I can state that there are a considerable number of typical localities which would help out such an inquiry. There is a peak (without a name) about thirty miles north of Gilgit, with rounded summit, which, though only 17,500 feet high, is covered with a cap of perpetual snow."

Speaking of the Himalayan glaciers, Col. Tanner stated that the most extensive and the most picturesque he has seen are in the Sat valley, which drains the southern face of Rakaposhi Mountain in Gilgit. Three great glaciers come down into this valley, and dispute with the hardy mountaineers for the possession of the scanty area of the soil. Here may be seen forests, fields, orchards, and inhabited houses all scattered about near the ice-heaps. The only passable route to the upper villages in this valley crosses the nose of the greatest of the three glaciers, and threads its way over its frozen surface. This glacier is cut up into fantastic needles of pure green ice, some of which bear on their summits immense boulders. About half a mile from its lower end or nose, Col. Tanner found an island bearing trees and bushes, and at one place above this a very considerable tarn of deep blue-green water. The glacier had two moraines parallel with each other, and both bearing pine trees; and, from the highest point Col. Tanner reached, he fancied he saw the ice emerging from the *névé* at its source, far away up the slopes of Rakaposhi. In this glacier the pinnacles, wedges, blocks, and needles of ice were of the most extraordinary appearance, and the whole formed a weird and impressive view which he can never forget. Though the largest glacier Col. Tanner has ever approached, it is very small indeed when compared with those described by Col. Godwin-Austen in a locality not very far from the Sat valley. Insignificant though it is, it was more than Col. Tanner could take in during his visit of two days' duration. It struck him at the time of his inspection that the peculiar stratified appearance of the ice needles, which in the case of the Sat glacier is very strongly marked, must have been caused by the different falls of avalanche snow on the bed of *névé* at the source of the glacier.

<sup>1</sup> From Nature of April 30.